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NEO-LIBERALISM IN CHILE AND ITS IMPACTS ON AGRICULTURE AND BIODIVERSITY CONSERVATION OF QUINOA:

A LESSON FOR STRENGTHENING AND DEVELOPING NEW PARTNERSHIPS

Enrique A. MARTÍNEZ*, Didier BAZILE**, Max THOMET***, José DELATORRE****, Erika SALAZAR*****, Pedro LEÓN LOBOS******, Ingrid VON BAER*******, Lizbeth NÚÑEZ********

* Marine Biologist - PhD Ecology, Centro de Estudios Avanzados en Zonas Aridas, La Serena – Chile (www.ceaza.cl), enrique.martinez@ceaza.cl
** Agroecologist and PhD Geography, CIRAD, UPR GREEN. France / Instituto de Geografía Pontificia Univ. Católica de Valparaíso– Valparaiso, Chile
*** Agronomist, CET-Sur ONG, Temuco, Chile
**** Agronomist, Univ. Arturo Prat, Iquique, Chile
***** Agronomist, INIA- Seed Bank La Platina, Santiago, Chile
****** Biologist-PhD Biology, INIA Seed Bank, Vicuña, Chile
******* Agronomist, Quinoa Seed producer and Seed improver, AGROGEN, Temuco, Chile.
******** Social Worker, Univ. Católica del Maule, Curicó, Chile

Abstract — Since 1973 Chile started a hard neo-liberal economy. This model affected education, health care and all economic activities, including agriculture. No protection and/or planning actions ruled the country that achieved a high GDP (US$14,510/year, per capita) respect to other Latino American countries, but also a very unequal salary distribution (Gini coefficient=0.54). It also achieved a worst land property distribution (Gini coef.=0.95 in some regions). Small-scale landowners received limited financial aid, they sold lands mainly re-oriented to monocultures for exportation markets. Farmers became rather workers of a growing agro-industry.

Quinoa (*Chenopodium quinoa)* a highly nutritive crop, cultivated since the last 7 thousand years in the Andes almost disappeared during the conquest but it was transmitted by ancient Incas to Chilean cultures, people living in very different agro-ecological contexts from 18ºS (Altiplano) to 41ºS (Chiloé Island). The crop was maintained in Chile where dust roads were cut by winter rains and where city supermarkets could not establish. There quinoa became one of their staple food and it escaped free-market driven agriculture that did not promote its cultivation. The 1470 hectares of quinoa in Chile (2007) could increase as Peru, Ecuador and Bolivia do export over 54 thousands hectares under biological certification. This new modern scenario might help to reactivate the culture of this crop in Chile. But the absence of farmer's organizations might become a constraint. Crop biodiversity is poorly known and mass cultivation could further reduce it unless some knowledge/research-action of this diversity could help to create conscience of its importance.

Key words: Agrobiodiversity, seeds system, companion modeling, role-playing game

Résumé — Depuis 1973 Chili a initié une politique economique néoliberale. Ce modèle économique a affecté l'éducation, la santé et toutes les activités économiques y compris l'agriculture. Sans planification les revenus par habitant ont beaucoup augmenté (US$14510/par an/per capita) par rapport aux autres pays de l'Amerique Latine mais, la distribution des salaires est devenue extrêmement inégale (Gini coef.=0.55). La distribution de la proprieté de la terre suit une courbe encore pire (Gini Coeff.=0.95 dans certains régions). Les agricultures à échelle locale, ou agricultures familiales, reçoivent peu d'aide de l'Etat. Progressivement les terres sont vendues et rapidement transformées en monocultures d'exportation. Les agriculteurs deviennent alors des travailleurs de l'agroindustrie.

Le quinoa (*Chenopodium quinoa*) est une plante très nutritive, cultivée depuis 7 mille ans dans les Andes. Bien qu'ayant disparu lors de la conquête espagnole il a pu être transmis par les Incas aux cultures chiliennes, à des groupes de population vivant dans des contextes agroécologiques très variés entre le 18°S (altiplano) jusqu'au 41ºS (Ile de Chiloé). La culture du quinoa s'est maintenue dans des zones isolées où l'accessibilité par route était impossible durant l'hiver, là où les supermarchés ne pouvaient pas s'établir. Le quinoa est devenu un aliment de base pour ces populations et il a échappé à l'agriculture de marché qui ne favorisait pas sa culture. Les 1470 hectares du quinoa au Chili (2007) pourraient augementer comme pour le Pérou, l'Equateur ou la Bolivie qui cultivent plus de 54 millies hectares de sous la certification biologique pour l'exdportation. Ce scénario moderne pourrait aider à réactiver sa culture au Chili. Mais l'absence d'organisations paysannes constitue un frein important. La biodiversité de récolte est mal connue et la culture de masse pourrait plus loin la réduire à moins que de la connaissance de cette diversité pourrait aider à créer la conscience de son importance. La diversité biologique est très mal connue pour cette plante et si la surface cultivée augmente la diversité génétique pourrait encore diminuer, à moins que la reconnaissance/recherche-action de sa diversité génétique élevée aide à prendre conscience de son importance.

Mots clés : Agrobiodiversité, système semencier, modelisation d'accompagnement, jeu de rôles.

INTRODUCTION

Since 1973 Chile was the first country to undergo a huge-scale social experiment of neo-liberal economy, based on free-market (Foxley 1982). This model was applied to education, health care and all economic activities including agriculture, with no protection actions, or minimal as those used today in Chile for price stability of wheat, for instance and nothing like subsides given today in Europe to farming activities. The neo-liberal model was applied under Draconian rules until 1981 where some adjustments were applied with no much improved results for the Chilean society (Ffrench-davis 2004). This model leaded the country to achieve a high GDP (US $ 14,510/year, per capita) respect to other Latino American countries. However best payed agro-industrial workers of the exportation agriculture only get half of this income (Valdés y Foster 2005). And the worst results is that the neo-liberal model also produced or increased a strong uneven salary distribution: The Gini coefficient has been high (0.54) since 1987, where 10% of richer people earn 29 times more than poorest people, a difference of only 9 times in developed countries of the OCDE group. These inequalities affect social life but it also affects territorial planning (CEPAL, 2009). Thus, public education was so unplanned respect to growth of biggest cities that in Santiago, the Capital (of five million people) so many students must take public locomotion to go to school that it ended by collapsing the public transport system. Schools were not built according to city growth. On top of that the 100 best scores of tests to enter the Chilean University system are obtained in 98% by private schools (www.demre.cl). The health care system is also collapsed because there are ten times more people in the public system than in the private system (www.supersalud.cl), due to lower costs of the public system. However the quality of the service given by public hospitals can not achieve the same standards obtained in the private clinics and public services are collapsed. In addition Chile faces a strong abuse in freedom for land use and also a property distribution that caused a decrease in small-scale landowners and agricultural practices aimed to monocultures for exportation markets (Economy Watch 2009, IMF 2009, OECD 2009). The Gini coefficient for land owners distribution is as high as 0.95 in the Araucania region (Garin y Ortega 2009). This model was also applied to other Latin American countries like Brazil (Brannstrom 2009) and Argentina Bárbaro (2003), with different degrees of effects on environment and resources (Liverman and Vilas 2006). This situation is more affected by strong price elevations, partially due to international crisis (today touching even European countries) or to the speculation caused by the land use in biofuel row matters (CEPAL-FAO-IICA 2009). In conclusion, the international scenario of develpment was the only one used for the national planification. Its impacts have generated many distortions between people and society, individual strategies and territory conception, nature and agriculture. The modernization is only considered under the prism of globalization (Figueroa & Simonetti, 2003). This raises the question of “where is the power”: State or private Companies? (Boisier, 1996). All of theses points are needed to unterstand the organization of the Chilean territory, the opposition between the power’s centralization and its other face of decentralization of private investments with a total access to the markets, aimed to increase the competitivity of Chile in the international markets (Valdés&Foster, 2005).

Quinoa (*Chenopodium quinoa*) is a crop cultivated since the last 7 thousand years in the Andes (Mujica et al. 2001). In Chile, this crop and its related culture almost disappeared but it was transmitted by ancient Incas to Chilean cultures, all ancestral people with different languages and living very different agro-ecological contexts along 3 thousand kilometers of the country length, from 18ºS to 41ºS (Chiloé Island). Most of these people, their languages and cultures were lost with the Spanish conquer, five hundred years ago. The crop was however maintained in Chile where no other crops could grow (as in the Altiplano at 3,500 to

4,000 m.a.s.l., Delatorre 2008) or where dust roads were cut by winter rains and where city supermarkets could not establish (coastal ridges in central Chile, Tagle and Planella 2002), quinoa being one of their staple needs. In the south of Chile the crop was kept by Mapuche's people respect to their ancient traditions (Sepúlveda *et al*., 2004), as also did the Aymaras in the Altiplano. If these farmers were not geographically isolated it is highly possible that it could have completely disappeared as it actually happened in other regions of Chile, such as the hyper-arid Region of Coquimbo in northern Chile where even the of "Quinoa" is unknown by farmers of 80 years old (Martínez *et al*., 2009a). In this Region the land use changes occurred early during the Spanish conquest and now soil use changes have accelerated. Thus, between 1997 and 2007 the region experienced a strong increase of exportable-fruit trees as table grapes, increasing its surface in 300% in that decade (Martínez *et al*., 2009b).

Today quinoa crop only reaches 1470 hectares in Chile but it gains world popularity among people looking for good quality and functional food alternatives (Bazile&Negrete, 2009). Peru, Ecuador and Bolivia have a strong quinoa exportation activity (Brenes *et al.,* 2001, Carimentrand 2002). This new modern scenario might helps to reactivate the culture of this ancestral crop in Chile but conflicts due to modern exportation markets and absence of farmer's organizations become strong constraints. However, the use of quinoa super food by our own children is still far from being a centralized or political option, although it should be so and drive more our internal markets. Its biodiversity is also poorly known by the very different, geographically dispersed, and unconnected farmers along the country.

1. **OBJECTIVE**

We propose a critical regard on the methods of science and researchers/farmers participation with other stakeholders to achieve conservation of agro-biodiversity in Chile, under the scenario of open global free-market operating in Chile.

2**. ORIGINALITY AND MAIN CONTRIBUTION**

The paper presents a review of various experiences in Chile about the conservation of quinoa, particularly describing the very first steps of small-scale farmers as they become involved into research initiatives, facing new market opportunities.

METHOD

We interviewed farmers, we reviewed Chilean experiences about quinoa conservation of genetic diversity, we characterized local agronomic practices, and the motivation of farmers. Then we constructed possible future scenarios, using local wisdom and participation of different stakeholders (research, farmers, government).

RESULTS

Farmers cultivating quinoa in Chile are often old (>60 years old in the Altiplano as well in the central coastal O'Higgins Region) and their surfaces do not exceed 10 hectares (see example of small-scale farmers yields in Table 1). This is also a picture of the whole rural system, where young people are abandoning rural life. Thus, there are less land owners and more agro-industrial workers (Fig. 1). Few cooperatives are interested in exportation, an aim provoking still poor incentives for associative efforts, even under government support. Subsides and credits of the National Government are focused to very poor farmers (<12 ha),

but once these farmers pass the poverty level banks only offer credits oriented for bigger demands like those implied in big exportation volumes. This inhibits growth of local markets, a particularly bad result, when quinoa has so good nutritional properties that could help to fight against increasing levels of obesity and malnutrition in Chile. Particularly obesity, which has reached high incidence levels, of 20% in children and 60% in adults (Mardones 2009).

Most Chileans ignore about quinoa, its ecological and cultivation diversity, its properties and how to consume it. The number of local varieties is small, compared to African experiences with Sorgho or Pearl millet (Bazile&Weltzein, 2008). Usually less than three quinoa varieties are cultivated by farmer exploitation, and no more than seven varieties are given names by most farmers in the Altiplano, a rich source of genetic diversity (Fuentes et al., 2009).

A review of most of Quinoa projects (Table 2) developed during the last 20 years revealed different objectives for all the projects, but few coordination among them, aimed for instance to selection and creation of new varieties (remaining only an initiative of private effort and funding), poor development of cooperatives, like Las Nieves, surviving from neoliberalism. This model, far from promoting their development has inhibited its creation. This Cooperative has the main objective of quinoa production for exportation markets so they started biological production certification steps. Now however they are selling all their production to Nestlé. It is this international industry which then export a transformed product made from quinoa flour. Conservation of biodiversity has been less addressed and INIA National seed bank receives samples (accessions) but there are no governmental funds for specific seed collection or seed renewal, a situation for quinoa but also or any crop seed. All quinoa accessions in the seed bank have come from independent seed collections. Aid to small farmers has been initiated years ago by CET-Sur in Southern Chile and by University Arturo Prat, connected to Altiplano Aymara communities in northern Chile. In arid Chile one CORFO project started to re-introduce quinoa among farmers that did not know what quinoa was. CET-Sur integrated some projects to conserve this crop, to promote *ex situ* conservation. Only recently governmental institutions like INDAP, created to help small-scale farmers, are interested in promoting quinoa cultivation but the absence of a clear local markets chains or lack of biological experience to compete with Bolivia or other countries has delayed this development. INDAP do give technical assistance but mostly associated to credits.
Local land races have been poorly characterized. However new governmental focus on “functional foods” again favoured by exportation opportunities than by local population health problems like obesity, diabetes and heart problems might help to promote quinoa cultivation. This can be seen as a challenge to discover what is good in different quinoa ecotypes or a threat to its biodiversity if few varieties could grow in big surfaces, causing extinction of the rest of the quinoa agro-biodiversity. Studies of local varieties and uses, its associated traditions and culture are needed to strengthen its conservation. The genetic richness of Chilean quinoa ecotypes can be seen from recent molecular studies undertaken in the country (Fuentes et al., 2009).

A new approach as raised from an international project (IMAS, standing for Impact of the Mode of Access to Seeds, funded by France research Agency ANR) that is aimed to understand farmers thinking when they decide to cultivate one or other local variety, how they inter-change they seeds, how market rules affect its decisions. For this objective new methods are being installed in Chile during different the phases of this project, like interviews, focus groups, fields experimentation and/or demonstration, workshops, scenarios co-construction, companion modelling, participatory analysis and role playing game. All stakeholders are invited to be present or represented, research, farmers, intermediate processors, local and national government, market opportunities, but also stochastic events like climate change and price changes in products and selling values.

Science might thus help farmers by demonstrating that this crop can grow with very low irrigation efforts, using local/regional crop biodiversity, as shown by Fuentes et al (200) and by Martínez et al. (2009a). Also by showing functional health properties, like quinoa effects on improving brain activity, even memory (Muñoz-Llancanao et al. 2008) and by helping farmers to discuss they opportunities, including their ancestral values, using interdisciplinary focus groups, with tools like participatory analysis (Bourgeois 2004, Hocdé et al. 2008) helped also by the use of multi agent modelling.

They, farmers, should realize that markets can be conquered and not only served. And that exportation is not the unique way to succeed. For this understanding science and its researchers should stay much closer to the final users.

CONCLUSIONS

Neoliberal economy dominates all Chilean society, including health care, education, retreat savings and also agriculture with strong emphasis in open exportation markets. Quinoa's traditional and ancient crop, not being an exported resource until present days, survived in Chile among geographically very isolated small-scale farmers, where other crops could not grow; where supermarkets where not nearby so they use it as a staple food and/or where traditional practices where inherited from ancient cultures (Aymaras in the high northern Altiplano, and Mapuches people in southern Chile).

Cooperatives or associative incentives are not very common in Chilean agricultural systems, mostly disappearing with the military "coup d'etat" in 1973. Modern government credits for individual small-scale farmers do help them but once they grow no other credit systems make a bridge between different production scales. Consumption of Quinoa grains, being highly nutritive for people of all ages, is not being promoted yet, but it should become so as obesity rates in Chile is increasing, also in people of all ages. This should be an opportunity for local farmers to re-start quinoa cultivation with small-scale internal markets, before starting bigger exportation volumes as those produced in Bolivia, Peru and Ecuador.

The diversity of quinoa ecotypes in Chile is poorly known but the great latitudinal range where it grows, from arid northern localities to cold and rainy ones in the south, with very different soil conditions is probably due to a great genetic diversity. This diversity needs to be well characterized and it should allow opportunities for cultivation under very different edaphic-climatic regimes.

Scientific community and farmers should face these challenges together and interact more as to re-discover quinoa's great opportunities as a stress-tolerant crop and as a good quality food source. This aim understands the *added value* of quinoa including its conservation and ancient farmers' traditions (cultural focus). This is different and richer than the *added value* of a nice packing for a candy that could have few quinoa grains with very low nutritive value, what is often promoted by neoliberal ideas (higher price-focus).

Table 1. Distribution of Quinoa yields (2007) and farmers in the political Regions of Chile, from the northernmost (I-19ºS) to the southernmost (IX-39ºS)

[Source: Censo Nacional Agropecuario de Chile 2007, www.ine.cl]

Region	Farmers	Ha	Production (Tons)	Yields (Tons/ha)
Total Country	**245**	**1454**	**8795**	**6,05**
I Tarapacá	**170**	**1374**	**8018**	**5,8**
II Antofagasta	**21**	**8,27**	**80**	**9,67**
III Atacama	**1**	**0,4**	**6**	**15,2**
IV Coquimbo	**6**	**3,10**	**38**	**12,26**
V Valparaíso	**1**	**0,1**	**1**	**10**
VI O'Higgins	**28**	**60**	**590**	**9,78**
VII Maule	**1**	**0,1**	**2**	**20**
VIII Bío Bío	**-**	**-**	**-**	**-**
IX Araucanía	**7**	**2,7**	**29**	**10,74**

Table 2. Analyses of some Quinoa Projects and its impacts on biodiversity conservation and farmers' organizations. CEAZA=Research Center in Northern Chile, CET-Sur=ONG, CORFO=Governmental funding institution, FIA=Governmental Funding of the Ministery of Agriculture, INIA=Agriculture and livestock research center of the Ministery of Agriculture, UNAP=University Arturo Prat, Northern Chile.

Project type	Funding source	Principal syakeholder (leader)	Level of farmer's participation	Analisis of biodiversity dynamics	New partnership and networks
Modern Variety : Regalona	**Private & FIA**	**Von Baer Seed producer**	**Experimentations in 4 Southern localities**	-	-
Cooperative QuinoaCOOP	**FIA**	**UNAP**	**Few farmers from only one comunity**	+	+
Protocol DAWE	**EU**	**CET-Sur**	**4 communities**	+++	+++
Cooperative Las Nieves	**FIA**	**President of Cooperative**	**10 farmer members+quinoa producors and sellers**	-	+
Re-introduction quinoa Coquimbo	**CORFO**	**CEAZA**	**10 farmers**	++	+++
National Seed Bank	**Cooperation Japan**	**INIA**	-	+	+
IMAS	**ANR-Francia**	**Cirad**	**Contacts with all the production regions in thecountry, but short participation**	+++++	++++

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Figure legend. A two-decade change in percentage of small-scale land owners and contracted agro-industrial workers in Chilean rural systems (after Valdés and Foster 2005).